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INTEGRATED WEED MANAGEMENT IN KHARIF MAIZE AT FARMERS FIELD IN CENTRAL PUNJAB

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ABSTRACT

In order to determine the effects of maize (Zea mays L.) and cowpea (Vignasinensis) intercropping on weed controls on farm trials were conducted at farmer's field in Jalandhar district of Punjab during 2011 and 2012 at four locations in kharif season. The experiment was laid out in a randomized block design with three replications comprising of five treatments, including Atrazine@ 2.0 Kg /ha, maize intercropped with cowpea (2:1) used as fodder 30 DAS, Maize intercropped with Cowpea (2:1) used as live mulch 30 DAS , one Hand Weeding (30 DAS) and unweeded control. The treatments significantly affected the weeds and crop parameters. Weed suppressing effects in intercropping combinations were higher as compared to other treatments. There is 35-56% reduction in weed population in intercropping treatments and Furthermore, cowpea acted as mulch, reducing weed biomass by up to 45.5% and 39.6%. All the treatments showed 16.9 to 27.9 % increase in grain yield of maize over control. Overall highest average grain yield of maize (4.9t/ha) was recorded in maize intercropped with cowpea (used as mulch) followed by maize intercropped with cowpea (used as fodder) 30 DAS which was 27.9 and 22.2 % higher as compared to control. Maize intercropped with cowpea used as fodder 30 DAS gave the maximum net return (Rs 16.4 ×10^3 /ha) but highest benefit cost ratio was obtained in maize intercropped with cowpea used as mulch 30 DAS. The lowest net return (Rs 9.9 ×10^3/ha) and benefit cost ratio was obtained in unweeded control.

KEYWORDS: Maize, Intercropping, Cowpea, Mulch, Weeds

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Original Article

INTRODUCTION

Maize (*Zea mays*) is grown on an area of 130 thousand hectares and is most widely cultivated summer cereal in Punjab. Its yield per hectare at farmers' field is very low as compared with the yield potential of existing cultivars. There are various factors which are responsible for low grain yield of maize but weed infestation is of most importance. There is 40-60 % reduction in maize crop yield has be reported due to weed interference (Thobatsi, 2009). Various studies showed that about 25–30 annual and perennial weed species grow in corn field (Evans et al., 2003). Maize is one of the most sensitive crop to weeds , if not controlled, specially at the initial phases of growth leads to the drastic decrease of yield. For weed management various cultural, biological and chemical practices are followed. Chemical control is the most widely used method but overdose of chemical herbicides and improper use may lead to many problems such as resistance of weeds and also create groundwater pollution and environmental pollution which is one of the most important human concerns (Abdin et al., 2000). Growing of cover crops is an alternative method to herbicides use for control of weeds. In the similar ways, the intercropping of legumes in cereal crops helps to reduce the pressure of weeds. Ability of intercropping in competing weeds depends upon factors such as mixture of tillable plants, selective numbers, and plant

aggregation, share of each tillable plant in intercropping, their layout and distance from each other, and prolificacy and moisture of the soil. Specifically among the legumes cowpeas are of great importance for this quality. So keeping, in view the above facts the present investigation was planned to study the effect of intercropping of cowpea on weed management in kharif maize.

MATERIALS AND METHODS

Field experiments were conducted at farmers' fields at four locations in district Jalandhar during summer 2011 and 2012. The climate of this region is characterized as sub tropical semi arid with hot summer and very cold winters. The soil (0-15 cm) of experiment locations was sandy loam to loamy sand in texture, low in organic carbon (0.31-0.35%), low available nitrogen (115.6 -119.7 kg/ha), high in phosphorus (20.2-20.4 kg/ha) and high in potassium (251-253.8 kg/ha). The experiments were laid out in a randomized block design comprising of 5 treatments, including atrazine @ 2.0 Kg /ha, maize intercropped with cowpea(2:1) used as fodder 30 DAS, maize intercropped with cowpea(2:1) used as live mulch 30 DAS , one hand weeding (30 DAS) and unweeded control and replicated thrice.

The sowing of maize (Cv. Punjab Maize Hybrid 1) was done in end may to first week of June in both the years. Well rotten farm yard manure @ 10 t/ha was through mixed in to the soil 2 weeks before the sowing. After a heavy pre sowing irrigation, the field was prepared by giving 2 ploughings followed by planking. Maize was sown in lines at a spacing of 60 cm × 20 cm for sole crop. In intercropping treatments, one line of cowpea (cv CL 367) was sown between the two rows of maize spaced at 60 cm apart. Atrazine @ 2 L/ha was applied within three days of sowing. Nitrogen was applied @ 125 kg /ha N through urea in three splits - at seeding, knee height and tesselings. After 30 -35 days of sowing the cowpea was harvested from the intercropped treatments and in maize intercropped with cowpea (2:1) used as fodder 30 DAS treatment, the cowpea was taken out of the field and used as fodder but in treatment maize intercropped with cowpea (2:1) used as mulch 30 DAS, the cowpea was first harvested and then spreaded on the surface between two rows of maize. The harvesting of the maize crop was done manually on last week of October in both the year of study. Data were recorded on plant height (cm), cob length (cm), no of grains per cob, cob diameter (cm), weed density (no/$m^{2),}$ weed dry matter (g/m^2) and weed control efficiency (%). The weed control efficiency (WCE) was calculated by using the following formula (Singh et al 2000)

$$WCE = (DMC-DMT)/DMC \times 100$$

Where, DMC is dry matter of weeds in control (unweeded) and DMT is dry matter of weeds in a particular treatment.

To work out economics, B: C ratio cost of cultivation and net returns were calculated. The variance was analysed using statistical measures at p=0.05.

RESULTS AND DISCUSSIONS

Effect on Weeds

The experimental fields were mainly colonized by *Cyperus rotundas*, *Trianthema portulacastrum*, *Echinochloa crus-galli*, *Dactyloctenium aegyptium* and C*ommelina benghalensis*. There was significant impact of different treatments on the reduction of density and weeds dry matter during both the years of study (Table 1) Highest weed density was observed in unweeded control while lowest was recorded where Cowpea was used as mulch followed by treatment where cowpea was used as fodder 30 DAS . In comparison to unweeded control all the treatments significantly reduced the

density of weeds. Weed suppressing effects in intercropping combinations were higher as compared to other treatments. The intercropping treatments resulted in 78-88% reduction in weed population. Furthermore, cowpea acted as living mulch, reducing weed biomass by up to 90.3%. Highest weed dry matter was recorded in control plot. Highest weed control efficiency (91.6%) was observed in maize: cowpea (mulch 30 DAS) followed by maize: cowpea (fodder at 30DAS). Atrazine @ 1.0 Kg /ha followed by hand weeding at 30 DAS gave least weed control efficiency due to higher weed dry weight (70.45 g/m^2 and 45.6 g/m^2 respectively) Dimitrios et al 2010 also found that maize intercropped with legumes considerably reduced the weed density compared with the monocropping maize. Maize – cowpea intercropping suppresses weeds growth. Hutchinson & McGiffen, 2000 also observed reduction in weed dry weights in non weeded cowpea mulch treatments in pepper.

Effect on Crop Growth and Yield and Economics

The results revealed that all the treatments significantly improved the growth parameters over unweeded control. Plant height was significantly affected where maize was intercropped with cowpea. The highest plant height was observed where cowpea was used as fodder after 30 DAS which was at par where cowpea was used as mulch after 30 DAS. Lowest plant height was observed in control plot. Maximum cob length (21.67 cm) was observed in maize intercropped with cowpea used as mulch followed by maize intercropped with cowpea used as fodder. There was significant difference between the number of grains per cob and cob diameter in all other treatments as compared to unweeded control plot. All the treatments showed 16.9 to 27.9 % increase in grain yield of maize over control. Similar results were also found by Gomes et al. (2007) .Overall highest average grain yield of maize (4.9 t/ha) was recorded in maize intercropped with cowpea (used as mulch) followed by maize intercropped with cowpea (used as fodder) 30 DAS which was 27.9 and 22.2 % higher as compared to control. Thus, intercropping reduced weed population and boosted maize performance. The result indicated that intercrop forage legumes with maize significantly affected the growth and grain yield of maize.

Economics of different treatments showed that maize intercropped with cowpea used as fodder 30 DAS gave the maximum net return (Rs 16.4 $\times 10^3$ /ha) but highest benefit cost ratio was obtained in maize intercropped with cowpea used as mulch 30 DAS. The lowest net return (Rs 9.9 $\times 10^3$/ha) and benefit cost ratio was obtained in unweeded control.

CONCLUSIONS

It is concluded that maize intercropped with cowpea if used as mulch after 30 DAS gave the effective weed control in maize as well as in improving the grain yield of maize by decreasing the weeds dry matter and boosted maize performance and hence increased the yield of maize. These treatment combinations i.e intercropping of maize with cowpea are agronomically feasible and farmers can adopt such practices for weed control in production of maize in central Punjab.

Table 1: Effect of Different Treatments on Weed Density, Dry Weight and Weed Control Efficiency in Maize at Harvest (Pooled Data of 2 Years)

Treatments	Weed Density (No/M^2)			Weed Dry Weight(G/M^2)			Weed Control Efficiency (%)		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Mean
Atrazine@ 1.0 kg /ha	48	52	50.0	69.6	71.3	70.45	44.7	51.3	48
Maize: Cowpea (fodder at 30DAS) 2:1	20	18	19.0	13.9	12.4	13.15	88.9	91.5	90.2
Maize : Cowpea (mulch at 30 DAS) 2:1	9	11	10.0	10.8	11.4	11.10	91.4	91.8	91.6
Hand weeding at 30 DAS	51	56	53.5	42.7	48.5	45.6	66.8	66.5	66.65
Weedy check	76	105	90.5	125.8	146.5	136.15	-	-	-
LSD(p=0.05)	2.06	5.3	2.7	2.4	3.6	2.04			

Table 2: Effect of Different Treatments on Growth, Growth Attributes Yield and Economics of Maize at Harvest (Pooled Data of 2 Years)

Treatments	Plant Height (Cm)	Cob Length (Cm)	Grains/ Cob (No.)	No Of Lines /Cob (No.)	Cob Diameter (Cm)	Grain Yield (T/Ha)	Net Return ($X10^3$/ Ha)	Benefit : Cost Ratio
Atrazine@ 1.0 kg /ha	249.87	19.90	452.2	13.47	45.83	4.48	10.4	1.38
Maize: Cowpea (fodder at 30DAS) 2:1	253.37	20.87	458.5	13.73	45.95	4.68	16.4	1.45
Maize : Cowpea (mulch at 30 DAS) 2:1	252.62	21.67	457.3	13.80	47.83	4.90	14.9	1.53
Hand weeding at 30 DAS	249.12	18.98	452.6	13.50	45.48	4.52	11.4	1.37
Weedy check	235.75	17.38	416.7	12.52	39.7	3.83	9.9	1.10
LSD(p=0.05)	2.73	0.55	3.4	0.10	0.38	0.11	-	-

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